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A NEW BOSTAERA FROM FLORIDA (Homoptera-Delphacidae*)

LAWRENCE R. PENNER
Department of Zoology and Entomology, University of Connecticut, Storrs

It has been possible for the author to study a large series of delphacine leaf hoppers in the genus *Bostaera* from Arizona, California, Colorado, Florida, Georgia, Kansas, New Mexico, North Carolina, and Texas. Florida specimens, a few from Georgia, and one from North Carolina are distinctly unlike the others, which, despite minor variations, have been identified as specimens of *Bostaera nasuta* Ball, 1902, the only recognized species in the Americas. They also differ markedly from *B. horvathi* Muir, 1934, of S. W. Africa, and from *B. bolivari* (Melichar, 1901) of Spain. The name, *Bostaera balli* n. sp., is given out of respect for the late Dr. E. D. Ball who was genuinely interested in the author's study of the genus.

Bostaera balli sp. nov.
(Fig. 1)

Resembles *Bostaera nasuta* Ball but easily separated by male aedeagus which has but 3 serrations on dorsal surface.

Male, length 4 mm.; wings 3.7 mm.

This species is similar externally to other species in genus, with head broader than pronotum and with first antennal segment flattened; color pale creamy to greenish-yellow with vertex and front shading to a more brownish color on a line below eyes, then lighter becoming brownish again on clypeus. Wings sub-hyaline, marked similarly as in other species. Dorsal aspect of aedeagus bears three serrations starting with smallest near apex, middle serration about twice size of first and third serration largest of all. Minute serrations appear along mesial aspect of aedeagus.

Female, length 4.8 mm.; wings 4 mm.

Slightly larger than male and similar in morphology and coloration except for genital differences.

Holotype ♂, allotype ♀, Hilliard, Florida, August 31, 1930, R. H. Beamer. Paratypes: FLORIDA: 2 ♂ ♂ and 1 ♀ Hilliard, August 31, 1930, L. D. Tuthill; 1 ♀ Hilliard, July 28, 1934, R. H. Beamer; 1 ♂ and 1 ♀ Hilliard, August 19, 1930, R. H. Beamer; 3 ♀ ♀ Hilliard, August 6, 1939, R. H. Beamer; 5 ♂ ♂ and 3 ♀ ♀ Waldo, August 18, 1930, R. H. Beamer; 1 ♂ Lacoochee, August 18, 1930, R. H. Beamer; 2 ♂ ♂ and 1 ♀ Sanford, August 9, 1926, E. D. Ball; 1 ♀ Sanford, September 2, 1926, E. D. Ball; 1 ♀ Gainesville, August 10, 1927, E. D. Ball; 1 ♂ Tampa, July 5, 1927 (probably collected by E. D. Ball); 1 ♂ and 2 ♀ ♀ Sanford, August 25, 1926, E.

* Contribution from the Department of Entomology, University of Kansas, and the University Farm, St. Paul, Minnesota.

D. Ball; 3 ♂ ♂ and 1 ♀ La Belle, July 16, 1939, R. H. Beamer; 1 ♂ La Belle, July 16, 1939, D. E. Hardy; 2 ♀ ♀ Suwanee Spr., August 2-3, 1939, D. E. Hardy; 1 ♀ Hiburnia, August 7, 1939, D. E. Hardy; 1 ♂ Hudson, July 13, 1939, R. H. Beamer; 1 ♂ Hudson, July 13, 1939, D. E. Hardy; 1 ♂ Branford, August 4, 1939, R. H. Beamer; 1 ♂ Branford, August 4, 1939, D. E. Hardy; 1 ♂ St. Mary's River, August 5, 1939, J. D. Beamer; 1 ♂ Naples, March 16, 1947, R. H. Beamer. NORTH CAROLINA: 1 ♀ Southern Pines, April 30, 1910, A. H. Mance. GEORGIA: 3 ♀ ♀ Adel, August 11, 1939, J. D. Beamer; 1 ♀ Adel, August 11, 1939, R. H. Beamer; 1 ♂ and 2 ♀ ♀ Adel, August 11, 1939, D. E. Hardy.

Types in Snow Entomological Collections; paratypes in U.S.N.M., and University of Minnesota Collections.

Bostaera balli sp. nov. is easy to separate from *B. nasuta* (Ball, E. D. 1902, Can. Ent., 34:266) in that the male is characterized by having three prominent apical aedeagal serrations (Figure 1) whereas *B. nasuta* has from 7 to 12 smaller serrations (Figure 2). The genitalia of a paratype male of *B. nasuta* collected at Holly, Colorado, by E. D. Ball on September 8, 1898, and loaned to me for study at the University Farm, St. Paul, Minnesota, by Colorado State College, Ft. Collins, Colorado, through the courtesy of Professor M. T. James, had 7 serrations on the aedeagus, the smallest number found out of numerous examinations of *B. nasuta* male specimens from

Figure 1. Aedeagus of *Bostaera balli* n. sp.
Figure 2. Aedeagus of *Bostaera nasuta* Ball, 1902.

several states. The usual number of serrations for *B. nasuta* however, appears to be nine. *Bostaera balli* is also slightly smaller (4-5 mm.) than *B. nasuta* (5-5½ mm.). The aedeagus of *B. horvathi* Muir is quite similar to that of *B. nasuta* and appears to have at least 7 serrations in Muir's illustration (Muir, F. 1934, Ann. Mag. Nat. Hist. 14:576) so consequently is not to be confused with *B. balli*. *B. horvathi* is also a smaller species (less than 4 mm.). *B. bolivari* is the largest species in the genus (6-6½ mm.). An aedeagal description was not available for *B. bolivari* and the original description is inadequate for comparative purposes (Melichar, L. 1901, Wien, Ent. Zeit. 20:55-56). It is quite unlikely that *B. bolivari* is the same as *B. balli* but a study of both *horvathi* and *bolivari* is in order to determine their relationships to *B. nasuta*.

EVIDENCE OF THE OVERWINTERING OF GREENBUGS IN SOUTHWESTERN KANSAS[1]

ALVIN E. LOWE[2]
Garden City, Kansas

The heavy infestations of greenbug aphids (*Toxoptera graminum Rond*) in Kansas the last several years have created much interest in whether or not they overwinter in the state. During the winter of 1949-50, the author observed them every month of the winter on winter wheat at the Branch Experiment Station near Garden City, Kansas. However, only winged adults were observed and so it was not certain whether they overwintered or migrated in at intervals during the winter.

Another heavy infestation of greenbugs occurred during the fall of 1950 and these insects were numerous by the end of October on newly emerged winter wheat. Wingless nymphs as well as winged adults were present throughout the fall and winter. The greenbugs apparently did not kill any wheat plants in the fall and early winter, but some large colonies killed individual leaves on which they were feeding.

The number of greenbugs on wheat increased during the months of October and November but decreased considerably during December. However, by the end of December living winged adults and nymphs were still easily found. The weather during December was neither mild nor unusually severe, as the temperatures were about average for the month. The only precipitation during December were traces of snow on December 5 and 29. The first snow blew off and offered little protection when the temperature went to —6°F. on December 6 and to —5° on December 7.

[1] Contribution Number 1, Garden City Branch Experiment Station.

[2] Associate Agronomist. These observations were made at the suggestion of Dr. R. H. Painter.

On the night of January 1, 1951, a 5-inch snow fell. It was a wet snow which lay where it fell and so it did not drift. This absence of drifting is unusual in the high plains of western Kansas. An additional two inches of snow fell on January 5 and another snowfall occurred on January 13, neither of which drifted. The three snows produced a total of one inch of water which entered the soil when the snow melted late in January. While the snow was on it, the wheat grew about an inch.

Winged adult greenbugs and nymphs of all sizes were found on the wheat on January 15 by digging down through the five inches of snow which lay over the wheat. All were alive, and as some of the nymphs were small, the question naturally arose whether the greenbugs were reproducing under the snow. However, this question could not be answered from the observations made.

The last few days of January, after the snow melted, both adult and nymphal greenbugs were plentiful and easily found. Also a few ladybird beetles were present.

The number of greenbugs increased during February, in spite of a severe cold wave the last of January and the first of February. The temperature dropped 64° in less than 24 hours and reached —14° the night of February 1 and —12° the next night. This severe cold weather occurred with little or no snow cover since most of the light snow had blown off. The cold had little effect on the greenbugs as they were abundant until a dashing rain of 0.84 inch fell on February 24. After this hard rain, the greenbugs were difficult to find and only a few were present until a flight occurred on March 26.

A few spring barley plants emerged the afternoon and night of March 26, and by 9 a.m. on March 27 nearly every plant had at least one winged adult greenbug, but no young, on it. Many plants had several adult greenbugs on them and a few were noted with as many as five. These plants were so small each consisted only of a single leaf of 1½ inches or less in length, having been emerged less than 24 hours. By 10 a.m. a few young greenbugs were observed, and by 11 a.m. young were observed by the side of nearly half of the adults and beside a few of the adults, two and three young were seen. By the next morning large colonies were present on most of the plants. However, the remainder of the barley soon emerged and the greenbugs scattered, so did little damage except to the first plants that had emerged.

Large flights of greenbugs ocurred on April 18, 19, and 20. They came in on strong south winds, and airplane pilots reported them up to 10,000 feet in the air. Actual counts gave an average of 6.6 greenbugs per spring barley plant on April 23 and the numbers increased to 13.8 by April 28. However, the weather warmed the following week so that ladybird larvae became numerous and in a week's time, the greenbugs were difficult to find. The greenbugs had seriously damaged the spring barley and oats, having killed an estimated one-fourth of the plants and seriously weakened the remainder. The aphids made many punctures on the leaves of winter wheat but killed only a few plants during the April invasion.

GREENHOUSE AND PRELIMINARY FIELD TRIALS FOR THE CONTROL OF THE RED SPIDER[1]

H. D. KOONE AND J. L. LANCASTER, JR.
Department of Entomology, University of Arkansas

Introduction

In comparative tests three promising sulfur compounds (1), beta-chlorethyl beta—(p-tertiary butyl-phenoxy)-alpha-methetyl sulfite (Aramite[2]), p-chlorophenyl, p-chlorobenzene sulfonate (Ovotran)[3], and p-chlorophenyl phenyl sulfone (Stauffer R242)[4] were shown to be highly toxic to the common red spider. All of the materials tested are residual compounds acting by contact. None have fuming action. In comparison to DDT all are relatively safe to warm blooded animals.

Greenhouse tests were conducted with Aramite, Ovotran, and Stauffer R242 during the winter of 1950-51. Aramite was used only as a spray while the other materials were used as sprays and dusts. In the field[5] dinitro ortho cyclo-hexylphenol and sulfur (DN-sulfur) was used in addition to those mentioned above. All were applied as dusts. Cotton was the host plant in both greenhouse and field tests.

Aramite, Ovotran and Stauffer R242 were used for the control of the red spider on watermlons when a severe outbreak occurred in the Horticulture Department greenhouse in 1951.

Greenhouse Trials

Experimental Procedure. Five individual leaves of a cotton plant were selected at random and tagged. A count of active spiders to the square inch was made and recorded for each tagged leaf. Plants were then sprayed or dusted with the various acaricides used. Spraying was done with a compressed air sprayer and dusting with a puff duster. Care was taken to secure complete coverage in all applications. A hand lens was used for counting, and the area on the underside of the leaf where infestation was heaviest was selected for all counts. Each series of applications was duplicated. Results were obtained by a count of active spiders to one square inch on each tagged leaf. Three such counts were made on different days on plants treated with Aramite, Ovotran, and the untreated check. Six counts on six different days were made on plants treated with Stauffer R242.

For controlling red spiders on watermelons two spray applications were made using three different acaricides. All spraying was done with a power

[1] *Tetranychus bimaculatus,* Order Acarina, Family Tetranychidae.
[2] U.S. Rubber Co., Naugatuck, Connecticut.
[3] Dow Chemical Co., Midland, Michigan.
[4] Stauffer Chemical Co., Houston, Texas.
[5] The authors wish to thank Fuller Farms, Gregory, Arkansas for use of their field in these investigations. Acknowledgment is also made of the assistance given by Mr. Vinzandt, County Agricultural Agent, Woodruff Co. and his assistant Mr. Barnett.
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sprayer at 40 pounds pressure. No pre-application counts were made but the infestation was heavy and general.

Results. All of the acaricides tested in the greenhouse gave excellent results when compared to untreated plants. Stauffer R242 appeared to be much faster acting than any of the other materials used, but almost complete kill was secured after a period of 13 days with all treatments. Detailed results are shown in Table I.

Three sections of the Horticulture Department greenhouse were sprayed March 28, 1951 for the control of *T. bimaculatus* on watermelons. One section was treated with Aramite at 2 pounds of 15 per cent material in 100 gallons; one section was sprayed with Ovotran at 2 pounds of 50 per cent material in 100 gallons; and the third section was sprayed with Stauffer R242 at 1 gallon of 17.5 per cent material in 100 gallons.

The plants were checked on April 4, 1951. No live spiders were found on those sprayed with Ovotran nor Stauffer R242, but there was plant injury in both sections. Ovotran caused spotting of the foliage of the melons

TABLE I. Average Number of Red Spiders to the Square Inch Where Different Acaricides Were Used On Cotton. Greenhouse—Fayetteville, Arkansas—1950-51.

Acaricide Used	Total Number of Leaves Counted	Mean Number Active Spiders to the Sq.In. Before	Mean Number Active Spiders to the Sq.In. After	Per Cent Reduction Over Check
Aramite (Spray)				
2 lbs of 15%*	10	26.0	2 days— 8.4	68
in 100 gallons			4 days—12.8	57
			13 days— 0	100
Ovotran	10	31.2	1 day —11.7	55
10%* dust			3 days— 3.4	89
			13 days— 0.6	99
Ovotran (Spray)			1 day —18.2	30
2 lbs. of 50%*	10	28.9	4 days— 4.9	84
in 100 gallons			13 days— 1.6	98
Stauffer R242	10	31.0	2 days— 0	100
10%* dust			4 days— 0	100
			5 days— 0	100
			9 days— 0	100
			11 days— 0	100
			14 days— 0	100
Stauffer R242 (Spray)			2 days— 0	100
3 qts. of 17.5%*	10	30.6	4 days— 0	100
in 100 gallons			5 days— 0	100
			9 days— 0	100
			11 days— 2	97
			14 days— 1	99
Check				
Sprayed with water	10	18.4	1 day —25.8	
			4 days—30.0	
			13 days—74.0	

* Per Cent active ingredient.

and also to tomatoes which were sprayed only to see if plant injury would result. Active spiders were found in considerable numbers on plants sprayed with Aramite.

All three sections were sprayed a second time on April 4, 1951. The dosage of Ovotran was reduced to 1.5 pounds in 100 gallons and Stauffer R242 was reduced to 3 quarts in 100 gallons to lessen plant injury. Aramite was used at the same dosage. Counts a week later revealed no active spiders on the foliage of the host plants in any of the three sections. Although excellent control was obtained, eradication of spiders from the three sections was not accomplished probably due to incomplete coverage of the inside area and reinfestation from an adjoining section.

TABLE II. Average Number of Red Spiders to the Square Inch Where Different Acaricides Were Used on Cotton. Field—Gregory, Arkansas—1951.

Acaricide Used	Rate to the Acre	Mean Number Active Spiders to the Sq.In. Before	Mean Number Active Spiders to the Sq.In. After	Per Cent Reduction Over Check
Top Application				
Aramite 10%* dust	16 lbs.	18.4	1 day — 7.5	43
			6 days— 2.5	74
			14 days— 2.5	76
Ovotran 10%* dust	14 lbs.	11.3	1 day — 3.7	72
			6 days— 2.9	70
			14 days— 2.1	80
Stauffer R242 10%* dust	14 lbs.	19.3	1 day —12.0	10
			6 days— 2.7	72
			14 days— 3.8	52
DN-sulfur .8%-92%* dust	26 lbs.**	17.7	1 day —10.8	18
			6 days— 2.0	79
			14 days— 3.8	64
Check		13.2	6 days— 9.6	
			14 days—10.4	
Top and Bottom Application				
Aramite 10%* dust	35 lbs.	13.8	1 day — 2.8	81
			6 days— 2.9	65
			14 days— 2.8	80
Ovotran 10%* dust	32.5 lbs.	6.1	1 day — 5.6	63
			6 days— 1.3	84
			14 days— 0.4	97
Stauffer R242 10%* dust 6	57 lbs.**	7.6	1 day — 4.7	69
			6 days— 0.2	98
			14 days— 5.9	59
DN-sulfur .8%-92%* dust	44 lbs.**	15.6	1 day — 9.2	39
			6 days— 3.3	60
			14 days— 4.9	66
Check		15.0	6 days— 8.3	
			14 days—14.4	

* Active ingredients.
** Dust flow unsatisfactory. Large part of amounts shown lost while getting duster readjusted.

Field Trials

History of Field. A field infestation was located about four miles south of Gregory, (Woodruff County) Arkansas. The cotton field was on new ground and had been sprayed five times with aldrin. The last aldrin treatment was applied two days before the acaricide test.

Design of Trial. The design of the field layout was three series of five plots, each six rows by one hundred feet long. Two series received treatment from the top only. A third series of five plots received treatment from both top and bottom in an effort to get complete coverage. This design was established as a comparison between partial and complete coverage because of the nature of the test materials, all being residual sulfur compounds. Since the red spider moves itself by walking only, it was hoped that it would come in contact with the treated surfaces and be killed. Top treatment only, if effective, would have an advantage because the application would be easier to make and require less material.

Treatment. Application to all plots was made in the morning on August 2 by a rotary type, two nozzle, hand duster. The duster containing dust was weighed before and after each plot was treated to determine the amount of dust applied in each plot. These amounts calculated to rate to the acre basis are shown in table II. An average was taken for the top treatments.

Results. Pre-treatment and result counts were made by pulling infested leaves from near the center of each plot. Fifteen counts of one square inch each were made from the underside of the leaves collected from each plot. Magnification was provided by a binocular microscope. A summary, showing the average number of active spiders to the square inch and the per cent reduction over the check is presented in Table II.

Ovotran shows a greater difference than the other materials tested when applied to obtain complete coverage. This is probably due to its slower action. It is recognized that a calculation of the per cent reduction based on the pre-treatment count favors top application over complete coverage in all cases except Ovotran. It is believed, however, that the more valid comparison is between the 14-day counts and the untreated check because of weather control which is indicated below. It should be noted in table II that at six days after treatment Stauffer R242 in the double application looked most promising with a 98 per cent reduction over the untreated check. At the end of two weeks, however, Ovotran showed a reduction of 97 per cent while Stauffer R242 fell back to 59 per cent. This tends to indicate, perhaps, a longer residual but slower action in the case of Ovotran.

It is probable that a large part, if not all, of the materials applied to the tops of the plants in all plots was removed by a rain which fell 8 days after treatment. Rain fell again on the 13th and 14th day after treatment. It should be noted that the 6 and 14 day counts in the untreated check were lower than the pre-treatment count, indicating some degree of weather control.

Summary

Good control of the common red spider was obtained under greenhouse conditions with all of the acaricides used. Eradication was not accomplished

in any section of the Horticulture greenhouse probably because of incomplete coverage of all the area and reinfestation from adjoining areas. Some plant injury was noted on watermelons and tomatoes. Preliminary field trials, based on the greenhouse tests, indicate that Aramite, Ovotran, and Stauffer R242 compare very favorably with DN-sulfur for the control of the red spider on cotton. Further work through replicated field trials is necessary before conclusions can be drawn.

The materials tested are of the long residual type acting by contact. All are relatively safe to higher animals.

LITERATURE CITED

GAINES, J. C., E. E. IVY, H. A. DEAN, AND A. L. SCALES. Toxicity of various sulfur and phosphorous compounds applied as sprays on spider mites and aphids. Jour. Econ. Ent., 43, No. 5, pages 614-619.

THREE NEW SPECIES OF HEBRIDAE (HEMIPTERA) FROM THE WESTERN HEMISPHERE

T. WAYNE PORTER
East Lansing, Michigan

While studying the taxonomy of the Hebridae, under the direction of Doctor H. B. Hungerford, three new species of *Hebrus* Curtis were discovered. Two are from the United States and one from Brazil.

Hebrus beameri n. sp.

(Figs. 1 and 2)

Size: Length, 1.22 mm. to 2.05 mm.; width across humeri, 0.63 mm. to 0.71 mm.

Color: Head fuscous to testaceous, antenna with first and second segments testaceous, distal segments darker; pronotum fuscous to testaceous, collar lighter, lateral edge of anterior lobe, dusky, humeri flavous to light testaceous; scutellum fuscous to testaceous; hemelytron smoky-brown, veins fuscous at either end, with middle portion testaceous, clavus smoky-brown, darker posteriorly, corium smoky-brown, membrane smoky-brown, with faint pallid transverse spot at distal end of vein, spot irregular in outline.

Structural characteristics: Vertex of head without medial longitudinal sulcus, two anastomosing rows of tiny pits in this area, slightly tumid above ocelli; pronotum with medial longitudinal sulcus variable but usually deep on anterior lobe, evanescent on posterior lobe, the two lobes demarcated by an irregular row of coarse punctures, posterior lobe with scattered punctures, collar bounded posteriorly by row of small punctures, humeri impressed inward, depression containing series of punctures which continue along posterior border of pronotum; hemelytron with inner vein produced

at distal end, membrane short, not reaching caudal border of abdomen; scutellum with medial longitudinal carina, evanescent posteriorly, lateral edges of scutellum slightly raised, apex rotund; parameres of male curved sharply upward at distal end, hook of paramere approximately as wide as long, dorsal surface of base tumid, numerous long setae scattered over surface of distal two-thirds of paramere.

Comparative notes: Superficially resembles *Hebrus comatus* D. & H. but can be readily separated from this species by the shorter wings and differences in parameres. *H. beameri* n. sp. have parameres with distal end curved sharply upward while *H. comatus* D. & H. parameres are long and cylindrical and lack the distal hook.

Location of types: In the Francis Huntington Snow Entomological Collections, University of Kansas, and in collection of Author. Holotype male; allotype female and paratypes, 63 males and 46 females. Meade Co., Kansas, 9-13-1944, R. H. Beamer; Meade Co., Kansas, May 2, 1948, R. H. Beamer, 5 males and 6 females; Meade Co., Kansas ,May 2, 1948, L. D. Beamer, 1 male and 2 females; Meade Co. St. Pk., Kansas, VI-7-50, R. H. Beamer, 43 males and 30 females; Meade Co. St. Pk., Kansas, L. D. Beamer, 15 males and 9 females. Type locality, Meade Co., Kansas.

Data on Distribution: Known only from Meade Co., Kansas. Doctor and Mrs. Beamer made special stops on two different occasions to collect more specimens of this new species. I wish to thank them for making this fine series possible.

Hebrus hubbardi n. sp.

(Figs. 3 and 4)

Size: Length, 1.65 mm. to 1.95 mm.; width across humeri, 0.65 mm. to 0.95 mm.

Color: Head fuscous to light fuscous, antenna testaceous, two basal segments ligl.ter; pronotum fusco-testaceous, collar fulvous to fusco-testaceous, anterior lobe darker; scutellum testaceous; hemelytron smoky-brown, veins black at ends, median portion fuscous, clavus smoky-brown, corium smoky-brown, membrane smoky-grey, without distinct spots; rostrum testaceous; legs testaceous; entire body with numerous coarse testaceous setae.

Structural characteristics: Vertex of head without medial longitudinal sulcus but with two anastomosing rows of punctures; pronotum with medial longitudinal sulcus deep on anterior lobe, evanescent on posterior lobe, anterior and posterior lobes demarcated by irregular row of coarse punctures, collar may or may not have a few fine punctures on posterior lateral edge; medial longitudinal carina of scutellum evanescent toward posterior end, apex of scutellum rotund, posterior border may be slightly incurved; hemelytron with inner vein produced at distal end, membrane extending to or nearly to caudal end of abdomen; parameres of male curved sharply upward at distal end, dorsal surface not tumid, surface of distal two-thirds of paramere with scattered long setae.

Comparative notes: This species is near *Hebrus concinnus* Uhler but can be separated by the different structures of the parameres. *Hebrus hub-*

vardi n. sp. has parameres that are curved sharply upward at the distal end and the hook is longer than wide, parameres of *H. concinnus* Uhler have the hook shorter than wide.

Location of types: Holotype male and allotype female in the U. S. National Museum. Paratypes, 2 males and 1 female, in the Francis Huntington Snow Entomological Collections, University of Kansas. Type locality, Palm Springs, California. Types bear label, Palm Springs California, 10-3, H. G. Hubbard. (No year given)

Data on Distribution: Known only from Palm Springs, California.

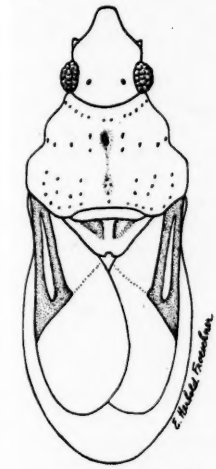

FIG. 1

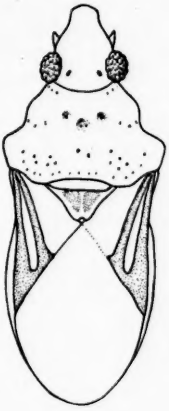

FIG. 3

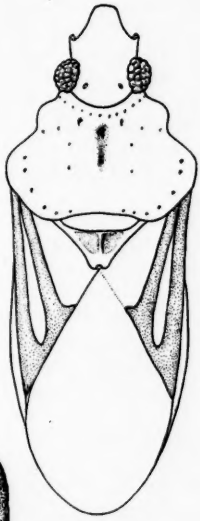

FIG. 5

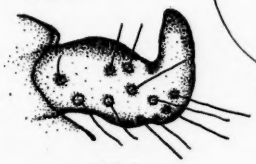

FIG. 4

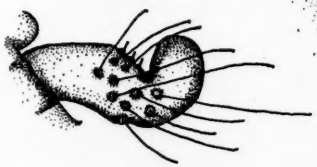

FIG. 2

FIG. 6

FIG. 1 HEBRUS BEAMERI N. SP.
FIG. 2 PARAMERE, HEBRUS BEAMERI N. SP.
FIG. 3 HEBRUS HUBBARDI N. SP.
FIG. 4 PARAMERE, HEBRUS HUBBARDI N. SP.
FIG. 5 HEBRUS PLAUMANNI N. SP.
FIG. 6 PARAMERE, HEBRUS PLAUMANNI N. SP.

Hebrus plaumanni n. sp.
(Figs. 5 and 6)

Size: Length, 1.85 mm. to 2.50 mm.; width across humeri, 0.67 mm. to 0.82 mm.

Color: Head fuscous, antenna fuscous, basal two segments lighter; pronotum fuscous, anterior lobe darker, outer portion of humeri dusky, base of anterior border of posterior lobe darker; scutellum fuscous, apex lighter; hemelytron fuscous, veins fuscous, darker at either end, corium smoky-brown, clavus with white wedge-shaped spot at base, posterior two-thirds smoky-brown, membrane smoky-grey, sometimes with subapical narrow oval whitish spot and a narrow white transverse mark at distal end of corium; bucculae fulvous, anterior tip fuscous; rostrum fulvous, first and second segments fuscous; legs fulvous, joints darker.

Structural characteristics: Vertex of head without medial longitudinal sulcus, with or without anastomosing row of punctures; pronotum with medial longitudinal sulcus deep on anterior lobe, evanescent on posterior lobe, lobes demarcated by an irregular row of coarse punctures, humeri depressed inward, with a series of punctures in depression that continue along posterior border of pronotum; scutellum with medial longitudinal carina, evanescent posteriorly, apex of scutellum incurved to bifid; hemelytron with inner vein produced at distal end, membrane extending nearly to tip of abdomen; parameres curved sharply upward at distal end, hook longer than wide, dorsal surface of base tumid, posterior two-thirds of paramere with scattered coarse long setae.

Comparative notes: This species is near *Hebrus hubbardi* n. sp. but is slightly larger and the parameres are unique.

Location of types: Holotype male and allotype female, in the private collection of Doctor Robert L. Usinger, Berkeley, California. Paratypes, 2 males and 1 female, in the Francis Huntington Snow Entomological Collections, University of Kansas. Type locality, Nova Teutonia, Brazil. These specimens were collected by Fritz Plaumann and dated XII-22-1935.

Data on distribution: Known only from Nova Teutonia, Brazil.

MUSCOID FLIES OF THE GENUS CHAETOPHLEPSIS (DIPTERA)*

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Members of the present genus are widely distributed throughout the New World and are occasionally encountered in economic work as parasites of lepidopterous hosts. In a recent attempt to identify some reared material, which necessitated a critical study of related forms, several apparently undescribed species were brought to light. None of the species of *Chaetophlepsis* have been reared or reported taken in large numbers with the exception of *tarsalis* and *orbitalis* in New England and *semiothisae* in Canada.

Townsend erected *Chaetophlepsis* in 1915, with *tarsalis,* new, as the type and sole original species (Proc. U. S. Nat. Mus., 49: 422). The type, in the U. S. National Museum, is a female from San Rafael, Casma, Peru. The original characterization is brief and inadequate but in 1939 Townsend published an amended description of the generic characters (Manual of Myiology, Part 8, 364).

The genotype, according to Aldrich (Proc. Ent. Soc. Wash., 25, 1923, 161), had been recorded previously from the White Mountains, New Hampshire by Coquillett as the European *Hypochaeta longicornis* Schiner (Revision of Tachinidae, 1897, 65). This, however, proved to be a misidentification as indicated by Aldrich's subsequent study of the type specimen in the Vienna Natural History Museum (Proc. Ent. Soc. Wash., 28, 1926, 144). *Hypochaeta* has about the same combination of external characters as *Chaetophlepsis,* differing mainly in having the first vein of the wing bare.

Twelve species of *Chaetophlepsis* are now known and all are included in the accompanying key. I am greatly indebted to C. W. Sabrosky, R. H. Beamer and H. Dietrich for the loan of material, which included several of the new species described below and added materially to the known distribution of other forms.

The exclusive characters of the genus may be briefly cited as follows: Ocellars long and reclinate; eyes hairy; clypeus well to deeply impressed; facial ridges bristled high above middle; propleura pale pilose; first vein setulose on its entire length; first posterior cell ending near wing tip; hind cross vein strongly retracted and much nearer small cross vein than cubitulus; last section of fifth vein exceeding one-half length of the preceding section.

The species of *Chaetophlepsis* are remarkably uniform in most of their characters. The items which apply to the members in common may be conveniently summarized here to avoid profitless repetition of details under the following specific descriptions:

*Contribution No. 1511, Department of Entomology, Texas Agricultural Experiment Station.

Front broad, rather heavily pollinose, vertex subequal to eye width; outer verticals absent; frontals in a single row, usually one beneath antennal base; parafacial narrow, bare; epistoma short, as wide as clypeus and in plane of latter; vibrissae on oral margin; proboscis short, labella fleshy; palpus slender, yellow; male antenna as long as face and a little shorter in female; arista bare, basal segments short; cheek bristled and clothed with pale hairs below, pollinose, less than one-half eye height; back of head flattened to gently convex, pollinose and rather sparsely clothed with pale hairs.

Thorax and scutellum black, usually densely pollinose, not vittate above. Chaetotaxy: acrostichal 3, 3; dorsocentral 3, 3; intraalar 3; supraalar 3; presutural 2 (inner one small); notopleural 2; humeral 4-5; postalar 3; pteropleural 0; sternopleural 2; scutellum with 2 lateral, 1 stoutish decussate apical and 1 weak discal pair; postscutellum well developed; side of postnotum beneath calypter and prosternum bare. Legs rather short and stout; tibiae reddish yellow, hind pair not ciliate; female tarsi somewhat thickened and serrate beneath in profile.

Abdomen ovate, narrower and longer than thorax, with pollen evident at least on basal margin of last three segments; hairs on upper surface of latter uniformly short and depressed; intermediate segments each with one pair of good-sized erect discals; first segment without, second with a pair of median marginals and third with an incomplete marginal row; anal segment with a complete discal and marginal row; sternites covered; male genital segments elongate and in repose not wholly retracted within tip of abdomen; forceps united, moderately long, tapering apically in the form of a curved beak; penis with a flattened basal segment, jointed near middle, distal segment brownish, with hind side strongly convex on apical half; female genitalia not adapted for piercing.

Key to Species of *Chaetophlepsis*

1. Male (unknown in *canora*) 2
   Female (unknown in *lipernis, atriceps* and *teliosis*) 12
2. Orbital bristles absent 3
   Orbitals present 5
3. Abdomen black in ground color 4
   Abdomen and legs largely reddish (Florida) ..... *townsendi* Smith
4. Vertex at least nearly equal to eye width; front scarcely diverging toward antennal base; abdomen largely or wholly gray pollinose, (Peru, U. S., widespread) ..... *tarsalis* Townsend
   Vertex distinctly narrower than eye width; front gradually widening to anterior extremity; abdomen moderately shining on broad hind margin of last three segments, (Mexico, W.I.) ..... *ancisa*, n. sp.
5. Orbital bristles one pair 6
   Orbitals two pairs 9
6. Epaulet pale reddish or yellow 7
   Epaulet infuscated or blackish; abdomen shining black with gray pollen confined to narrow basal margin of last three segments;

claws and pulvilli as long as last tarsal segment, (Peru, Western U. S., Ontario) ..... *ucayali* Townsend

7. Third antennal segment black 8
Antenna wholly bright reddish yellow; arista black on thickened base; front and parafacial with heavy silvery white pollen, (N. C.) ..... *teliosis*, n. sp.

8. Front widening gradually to antennal base, yellowish gray to pale golden pollinose; abdominal pollen gray with a distinct greenish sheen, rather dense and uniform over entire surface of last three segments above, (Wash. State) ..... *nasellensis*, n. sp.
Front equibroad, usually cinereous but sometimes with a yellowish tinge; abdomen with heavy subsilvery pollen on narrow base of segments 2 to 4, the remainder of each subpollinose and moderately shining, (Ohio; Canada, N.B. to B.C.) ..... *semiothisae* Brooks

9. Abdomen shining black, with thin gray pollen on last three segments becoming denser towards base of each 10
Abdomen wholly opaque, the pollen gray with a faint greenish tinge; arista thickened to middle or beyond; last section of fifth vein two-thirds to three-fourths length of preceding section, (New England) ..... *orbitalis* Webber

10. Middle tibia with one anterodorsal bristle 11
Middle tibia with two anterodorsals; arista thickened on basal fourth thence suddenly constricted and very slender to tip; thorax above with heavy gray pollen; wings with a yellowish tinge on costal margin, (Brazil) ..... *lipernis*, n. sp.

11. Two frontal bristles beneath antennal base; parafrontals with a distinct yellowish tinge; antenna as long as face; arista thickened and evenly tapered beyond basal third, (Calif.) ..... *rindgei*, n. sp.
One frontal beneath antennal base; parafrontals gray pollinose; antenna a little shorter than face; arista thickened on about basal fourth thence slender to tip, (Ohio) ..... *atriceps*, n. sp.

12. Abdomen black 13
Abdomen and legs reddish ..... *townsendi* Smith

13. Vertex equal to or exceeding eye width, front equibroad or nearly so 14
Vertex narrower than eye width and front distinctly widening downward; cruciate frontals at base of antennae stout ..... *ancisa*, n. sp.

14. Epaulet infuscated and strongly contrasting with pale subepaulet 15
Epaulet and subepaulet concolorous, pale reddish to yellow 18

15. Abdomen largely or wholly opaque gray 17
Abdomen shining black on broad hind margin of last three segments; vertex one-third head width 16

16. Parafrontal yellowish pollinose ..... *ucayali* Townsend
Parafrontal opaque gray; second antennal segment rufous *rindgei*, n. sp.

17. Vertex one-third head width; arista thickened on basal fourth ..... *tarsalis* Townsend

Vertex two-fifths head width; arista thickened on basal half ..... *orbitalis* Webber

18. Sternopleuron sparsely black-haired 19
Sternopleuron with scanty intermixed pale and black hairs; abdomen lightly dusted with grayish pollen which becomes paler and denser on narrow base of last three segments; calypters whitish; front gray to yellowish gray pollinose ..... *semiothisae* Brooks

19. Front yellow to pale golden; thorax and abdomen above with heavy olivaceous gray pollen; calypters tawny ..... *nasellensis*, n. sp.
Front pale ash gray; thorax and abdomen wholly cinereous, the pollen dense with only a faint brassy luster on abdomen above; calypter white, (N. Y.) ..... *canora*, n. sp.

Chaetophlepsis tarsalis Townsend

Chaetophlepsis tarsalis Townsend, Proc. U. S. Nat. Mus., 49, 1915, 422; Manual of Myiology, pt. 8, 1939, 364.—Aldrich, Proc. Ent. Soc. Wash., 25, 1923, 161; Op. cit., 28, 1926, 143.—West, N. Y. State List, 1928, 810.—Allen, Ann. Ent. Soc. Am., 22, 1929, 683.—Webber, Proc. U. S. Nat. Mus., 78, Art. 20, 1931, 1-4.—Knowlton, Utah Acad. Sc., 13, 1936, 241.—Brimley, Ins. N. C., 1938, 359.

Hypochaeta longicornis Coquillett (nec Schiner), U. S. Dept. Agr., Div. Ent., Tech. Bull. 7, 1897, 65.—Aldrich, Cat. N. A. Dipt., 1905, 436.

Hypochaeta eudryae Smith (partim), Proc. Ent. Soc. Wash., 18, 1916, 94.

The history of the species as published by Aldrich has been reviewed briefly in the introductory paragraphs above. It is one of the most widespread members of the genus ranging from Peru to New Hampshire and Massachusetts. I have collected the species in limited numbers at College Station, Texas (May, October, and November) and Amherst, Ohio (June and July). Its distinguishing characteristics may be listed briefly as follows: front nearly one-third head width in both sexes; parafrontal and frontal vitta with heavy pale gray pollen sometimes tinged with yellow on latter; male without orbitals, two proclinate pairs in female; thorax densely cinereous pollinose above; wing hyaline; epaulet infuscated; calypter white; costal spine small but distinct; claws and pulvilli about equal to length of last tarsal segment in male but distinctly shorter in female; abdomen largely or entirely gray pollinose. Recorded as a common parasite of *Alypia octomaculata* Fab. in Massachusetts and also reared from *Autographa oo* Cram. in Mississippi by Webber and Allen, respectively.

Chaetophlepsis townsendi (Smith)

Hypochaeta townsendi Smith, Proc. Ent. Soc. Wash., 18, 1916, 94.

Chaetophlepsis townsendi (Smith), Aldrich, Op. cit., 25, 1923, 162; 28, 1926, 145.—Webber, Proc. U. S. Nat. Mus., 78, art. 20, 1931, 1.

The species was described from a male specimen taken October 27, at Miami, Florida, by C. H. T. Townsend. This appears to be the only material hitherto recorded in literature. A female in my collection without collector's label bears the following data: Fort Mead, Florida, August 30, 1919. It has the peculiar tarsal structure of the type species. The abdomen is

largely reddish and the legs wholly so; these items instantly distinguish the species from all other members of the genus. Length 5.25 mm.

The male type, which I have not seen, is in the U. S. National Museum.

Chaetophlepsis ancisa, n. sp.

In this form the front is distinctly narrower and more divergent forward than in any of the related species.

Male.—Front at vertex 0.24 and at base of antennae 0.36 of head width; parafrontal and vitta pale yellow gray pollinose, no orbitals but with a few moderate-sized proclinate hairs outside the main frontal row; clypeus deeply sunk; facial ridges bristled high above middle; antenna as long as face, basal segments with a reddish tinge, third black, rather broad, straight on anterior margin; arista very slender on apical three-fourths, thickened basal part dark brownish black; parafacial and cheek gray pollinose, latter barely one-fourth eye height; palpus red, rather slender to tip. Thorax and scutellum black and rather densely gray pollinose, wing subhyaline showing a slight yellowish tinge on broad costal margin; third vein with three or four hairs near base; last section of fifth vein over two-thirds length of preceding; costal spine minute; calypter pale tawny. Legs black, tibiae more or less reddish, middle pair with two anterodorsal bristles; claws and pulvilli nearly as long as last tarsal segment, abdomen mostly shining black, last three segments gray pollinose on about basal fourth; first genital segment black, second obscurely reddish; forceps rather long and slender, terminating in a bowed acute-tipped beak.

Female.—Vertex 0.26 of head width; two pairs of orbitals; antenna slender, a trifle shorter than face; clypeus only moderately sunk; palpus thickened apically or spatulate; claws and pulvilli short; otherwise similar to male.

Length, 5 mm.

Holotype male, "Mexico" and allotype female "West Indies", in the U.S. National Museum.

The types appear to have been collected many years ago and are not too well preserved.

Chaetophlepsis ucayali Townsend

Chaetophlepsis ucalayi Townsend, Rev. Chil. Hist. Nat., 32, 1929, 379.
Chaetophlepsis polita Brooks, Can. Ent., LXXVII, 1945, 83.

Hitherto known only in the type specimen (female) from Peru, now in the U. S. National Museum. The species differs from *tarsalis* chiefly in having the abdomen shining black on the broad apices of the last three segments. *Polita* appears indistinguishable from *ucayali*. Although widely distributed, the species is known in comparatively few specimens. The material examined includes one male in the U. S. National Museum, labeled "Polk Co., Wis., July, Baker, Collection Aldrich", and three females in the Kansas University Collection as follows: Bray, Calif., June 30, 1935 (R. H. Beamer); Lone Pine, Calif., July 28, 1940 (R. H. Beamer); and Dixie, Ore., July 8, 1931 (J. Nottingham).

Chaetophlepsis canora, n. sp.

Similar to *tarsalis* but paler gray in general aspect, the front a little wider and the epaulet and subepaulet concolorous, pale reddish yellow.

Female.—Head densely pale cinereous pollinose; vertex 0.35 of head width; parafrontal bearing two proclinate orbitals and a few minute black hairs on outer anterior extremity; one frontal bristle below antennal base; clypeus moderately sunk; facial ridges with rather strong bristles on lower three-fourths; cheek pale-haired below, fully one-third eye height; antenna slender, basal segments reddish, third black extending to lower fifth of face; arista blackish on thickened proximal fourth, thence paler and very slender to tip; palpus pale yellow, slightly thickened apically. Thorax and scutellum with dense opaque cinereous pollen. Wing hyaline, with a rather faint but uniform yellowish tinge; veins including costa pale yellow, third with two or three hairs near base; last section of fifth vein slightly over one-half length of preceding; costal spine doubled, shorter than small cross vein; calypter transparent white. Middle tibia with two anterodorsals; tarsi characteristically serrate beneath, moderately thickened. Abdomen entirely covered with dense gray almost lusterless pollen, which shows a slight brassy tinge on all segments above; sternites covered; genitalia retracted.

Length, 5.5 mm. Male unknown.

Holotype female, Hempstead, L. I., N. Y., June 5, 1921, (H. C. Huckett) in the Cornell University Collection.

Chaetophlepsis teliosis, n. sp.

Male.—Front at vertex 0.31 of head width, scarcely widening forward; parafrontal, frontal vitta, parafacial and cheek with heavy silvery white pollen; facial profile slightly convex, clypeus deeply sunk; palpus yellow, beset with short pale and black hairs on apical half; antenna wholly red, third segment broad and about as long as face; arista black on thickened basal third, somewhat paler and slender beyond; cheek pale-haired below, one-third or more eye height. Legs black, tibiae reddish yellow, middle pair with one anterodorsal bristle; claws and pulvilli fully as long as last tarsal segment. Wing lightly tinged with yellow on costal margin and along veins; costal spine minute; third vein with three hairs near base, the outermost bristlelike; last section of fifth vein about three-fifths length of preceding; calypter white. Abdomen black, with cinereous pollen which becomes denser on basal fourth of last three segments. Length 5.5 mm.

Holotype male, "Raleigh, N. C., August 17, 1926," in my collection.

Chaetophlepsis nasellensis, n. sp.

Male.—Front at vertex 0.36 and at antennal base 0.44 of head width; frontal vitta with dense yellowish pollen which appears blackish in a flat rear view, about three times wider than parafrontal; latter with one pair of orbitals and a few small hairs on lower part; facial profile slightly convex; clypeus deeply sunk; antenna reaching to vibrissae, basal segments obscurely reddish, third broad and wholly black, eight to ten times longer than second segment; arista thickened on basal third or more; cheek nearly

two-fifths eye height. Thorax with rather dense grayish pollen, which shows a slight brassy tinge on mesonotum. Wing extending beyond tip of abdomen, hyaline with a slight yellowish tinge, except along hind margin, veins yellow, last section of fifth vein only slightly over one-half length of preceding; costal spine vestigial; calypter tawny. Legs black, tibiae reddish yellow, middle pair bearing one anterodorsal bristle; claws and pulvilli not quite equal to length of last tarsal segment.

Female.—Vertex 0.38 of head width; front with two pairs of proclinate orbitals; clypeus moderately impressed; antenna somewhat shorter than face, basal segments reddish yellow, third moderately slender, about five times longer than second; middle tibia with two anterodorsals; claws and pulvilli short; otherwise similar to male.

Length, 6-7 mm.

Holotype male and allotype female, Naselle River, Washington, November 5, 1930 (W. J. Buckhorn) in the U. S. National Museum. Paratypes; 1 male and 4 females, same data as type.

The type series is not in good condition; the head bristles have suffered considerable damage but the peculiar coloration and larger average build of the species appear distinctive.

Chaetophlepsis semiothisae Brooks

Chaetophlepsis semiothisae Brooks, Can. Ent., LXXVII, 1945, 82.

A rather common parasite of *Semiothisa* spp. in Canada, ranging from New Brunswick to British Columbia. The description states that the male claws and pulvilli are shorter than the last tarsal segment. In the material examined, which includes one male and two female paratypes from Quebec and one male from Ohio, there is a noticeable variation in the length of the male claws and pulvilli. The latter are nearly as long as the apical tarsal segment in the paratype but distinctly shorter in the Ohio specimen. The value of a rather minute character employed in the key to distinguish the female from the preceding species is open to question. In the only two examples (paratypes) that I have seen, there are a few inconspicuous pale hairs intermixed with the black vestiture of the sternopleuron. In all the other known forms the sternopleural hairs are uniformly black. Length 4-5 mm.

Holotype male and allotype female, Constance Bay, Ontario, in the Canadian National Collection.

Chaetophlepsis orbitalis Webber

Chaetophlepsis orbitalis Webber, Proc. U. S. Nat. Mus., 78, art. 20, 1931, 2.
Hypochaeta eudryae Smith (partim), Proc. Ent. Soc. Wash., 18, 1916, 94.
Chaetophlepsis tarsalis Aldrich (nec Townsend) (partim), Proc. Ent. Soc. Wash., 25, 1923, 161.

In the above citation Aldrich pronounced *Hypochaeta eudryae* Smith a synonym of *Chaetophlepsis tarsalis* Townsend. Subsequently Webber pointed out that Smith's type series included a mixture of two species; that the holotype (from Newton, Mass.) and one paratype specimen (from White Mts.,

N. H.) were synonymous with *tarsalis,* and that the remainder of the series (from Oswego, N. Y.) represented a distinct species. Webber's detailed description of the latter is based upon a long series mainly reared from *Cingilia catenaria* Drury at the Gypsy Moth Laboratory. The species, though similar to *tarsalis,* is readily distinguished in the male by the wider front, two pairs of proclinate orbitals and the shorter claws and pulvilli. Females of the two forms are not easily separated and some of the items listed by Webber do not appear distinctive. Among those mentioned perhaps the wider female front is the most reliable distinguishing feature. The range of *orbitalis* appears restricted to the N. E. States.

Holotype male and allotype female, from Sherborn, Mass., are in the U. S. National Museum.

Chaetophlepsis lipernis, n. sp.

Male.—Front at vertex 0.32 of head width; parafrontal, parafacial, and cheek with heavy tawny gray pollen; two stoutish orbitals; one frontal bristle below antennal base; clypeus deeply sunk; facial ridges rather strongly bristled high above middle; antenna subequal to length of face, black, basal segments obscurely reddish; arista very slender on apical three-fourths, thickened basal part brownish black; palpus reddish yellow, moderately thickened apically; cheek hardly one-third eye height, with several bristly hairs at middle and clothed with fine pale hairs below. Thorax and scutellum black, with dense gray lusterless pollen above. Wing subhyaline with a rather distinct yellowish tinge costally; veins brown, third with two hairs near base; last section of fifth vein about three-fifths length of preceding; calypter pale yellowish white; costal spine subequal to length of small cross vein. Legs black, tibiae obscurely reddish, middle pair with two anterodorsals; claws and pulvilli shorter than last tarsal segment. Abdomen largely shiny black but with thin gray pollen on basal half of last three segments above; genital forceps as in related forms but somewhat smaller than usual; accessory process reddish, chitinized as usual and punctate on outer side, broader than forceps in profile and terminating in a minute tooth.

Length, 5 mm. Female unknown.

Holotype male, West border, Matto Grosso, Brazil, May, 1931 (R. C. Shannon) in the U. S. National Museum.

Chaetophlepsis rindgei, n. sp.

Male.—Front at vertex 0.35 and at antennal base 0.42 of head width; frontals in a single row, two beneath base of antennae; two pairs of proclinate orbitals; frontal vitta blackish, thinly pollinose, parafrontal with slightly heavier and more brassy pollen, sparsely clothed with short black hairs outside frontal row; parafacial narrow, grayish becoming paler downward; clypeus deeply sunk; facial ridges bristled to upper fourth; antenna wholly black, third segment broad and slightly concave on front edge, reaching to oral margin; palpus slender, yellow; cheek beset with fine pale hairs, one-third or more eye height; back of head cinereous pollinose, with a sparse vestiture of short whitish hairs. Thorax and scutellum black, the

gray pollen moderately dense but somewhat shiny above. Wing gray hyaline, no costal spine; veins brownish black, third bearing two hairs near base; last section of fifth vein about two-thirds length of preceding; calypter pale tawny. Legs black, tibiae yellowish, claws and pulvilli short. Abdomen shining black, last three segments with gray pollen extending thinly beyond middle of second and third but restricted to basal fourth or less on the anal segment; genital segments black, the first slightly longer than forceps; accessory process slightly shorter and broader than forceps in profile, terminating in a minute tooth at apex.

Female.—Vertex 0.33 of head width; clypeus only moderately impressed; antenna rather slender, three-fourths as long as face, basal segments reddish; thorax more densely pollinose and less shiny above than in male; middle tibia with two stoutish anterodorsal bristles; tarsi serrate ventrally as viewed in profile; abdomen broader and somewhat less extensively pollinose than in male.

Length, 5 mm.

Holotype male and allotype female, King's Mtn., San Mateo Co., Cal., September 1 and 8, 1948, (Fred H. Rindge) in the California Academy of Sciences Collection. Paratypes: 1 male and 1 female, same data as type.

The type series was reared from *Drepanulatrix monicaria* Gn. by Fred H. Rindge, for whom the species is named.

Chaetophlepsis atriceps, n. sp.

Very similar to the preceding species except as follows: Male.—Front at vertex 0.33 of head width; parafrontals with changeable plumbeous pollen appearing blackish in some views, frontal vitta concolorous and at mid front barely exceeding twice parafrontal width; one frontal bristle beneath antennal base; cheek decidedly blackish, with rather thin plumbeous pollen which is changeable with the angle of view; antenna somewhat shorter than face, third segment moderately broad, straight on anterior edge; palpus statulate; back of head subshining black, with thin grayish pollen, the pale vestiture intermixed with coarser black hairs above; thorax and scutellum very thinly gray pollinose and distinctly shiny in most views; wing hyaline with a faint yellowish tinge basally and along costal margin; veins yellow, third with four or five hairs near base; costal spine doubled, small but distinct; calypter transparent white; abdomen shining black, last three segments with very thin gray pollen which does not become much denser on basal margin of each; forceps a little longer than first genital segment; accessory process moderately broad, hardly tapering toward apex and only about two-thirds as long as forceps.

Length, 5.5 mm. Female unknown.

Holotype male, Amherst, Ohio, June 26, 1924 (H. J. Reinhard) in my collection.

ANGOUMOIS GRAIN MOTH IN THE CORN BELT

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The Angoumois grain moth (*Sitotroga cerealella* (Oliv.)), has long been a serious pest of corn in the southern portion of the United States, but only occasionally has it been of any consequence in the Corn Belt, and then only in the southern parts of Ohio, Indiana, Illinois, Missouri, and Kansas. A succession of mild winters, bumper yields, and large stocks of ear corn carried over in farm storage provided unusually favorable conditions for the northward spread and increase of this insect for several years preceding the winter of 1950-51. Its importance as a pest of corn is due to the fact that for the first season it breeds readily on ear corn stored in slat cribs. The emerging moths are able to crawl throughout the cribs to lay their eggs, and by midsummer a very high percentage of the ears may be infested.

The adult insect closely resembles a clothes moth in appearance. It is light grayish brown and has a wingspread of ½ to ⅔ inch. In the summer the moth flies to the field from infested grain in storage and lays its eggs on the tips of ears with loose or damaged shucks, or it may remain to infest other grain in storage. Since much of the hybrid corn has a relatively loose shuck, it is rather susceptible to attack. The female moth lays her eggs singly or in small clusters and is capable of laying from 40 to 300 eggs. After hatching, the young larva burrows into the kernel, where it feeds until full grown and then pupates. Most of the individuals that survive the winter do so as full-grown larvae. The length of the life cycle is approximately 5 weeks during the summer, but in the winter it is much longer. There may be two or more generations per year in Kansas and central Illinois.

Low temperature is the most important factor limiting the winter survival of the Angoumois grain moth, and only occasional outbreaks have occurred in the Corn Belt; the last serious one was several decades ago. In the summer of 1949 an unusually high population of the insect in the area prompted winter-survival studies in Kansas and Illinois during the season of 1949-50.

Boxes of infested ear corn were obtained in the fall of 1949 and were located on farms spaced at regular intervals from south to north in each State. Representative ears were taken from each box throughout the winter months, shelled in the laboratory, and the infested kernels were placed in jars in a warm room. The numbers of moths that emerged were removed and recorded every other day for a 5-week period. The results of these studies indicated that in Kansas the moth did not survive the winter at Manhattan, in Riley County, or at points farther north. In Illinois it survived at all points except at Belvidere, in Boone County, which was the

[1] Transferred to Army Quartermaster Corps on April 13, 1951.

northernmost point in the test. In both States the numbers that survived were progressively greater from north to south.

The field observations were supplemented by laboratory tests to determine how long adult and larval stages were able to withstand temperatures of 0° and 10°F. The insects to be exposed were confined in screened vials 25 mm. by 95 mm., which were lowered into large glass test tubes immersed in a refrigerated liquid bath in which temperatures accurate to 0.1° could be maintained. The test tubes had an inside diameter of 3.5 cm. and a depth of 19 cm., and were closed at the end with rubber stoppers, which provided good insulation from the outside air and materially reduced frost accumulations on the inside. A series of 3 replications was used for each exposure period. At a temperature of 0°, all adults were dead after an exposure of 15 minutes, whereas the immature stages were able to withstand an exposure of 1 hour. At 10° the moths succumbed to an exposure of 50 minutes, and 100 percent mortality of immature forms was obtained after an exposure of 24 hours. The late larval and pupal stages were the most resistant to the cold.

On the basis of the findings in Kansas in the winter of 1949-50, there is seldom, if any, survival of the Angoumois grain moth in ear corn north of the Kaw River Valley in that State, while progressively greater survival occurs southward. In Illinois, survival as far north as Kendall County is probably the exception. In normal years a line between St. Louis, Missouri, and Vincennes, Indiana, will probably represent the northern limit at which the moth survives the winter.

Measures to control the Angoumois grain moth in held-over corn are frequently necessary in the southern part of the Corn Belt. Ear corn left in the crib during the summer months is likely to be badly infested by fall and its value reduced considerably. The corn should therefore be shelled early —before warm weather arrives in late spring—and stored in clean, dry, and tight bins. After such shelling and storing, however, the corn is still subject to infestation, especially in the upper foot or so, into which the moths can penetrate and lay their eggs. To prevent this, the surface of the corn should be sprayed with a refined oil of 100-200 seconds Saybolt viscosity, and free from objectionable odor, at the rate of 2 quarts per 100 square feet. This treatment will protect the corn from damage by the Angoumois grain moth and from other insects that might migrate into the bins during the summer.

Old grain and refuse serve as a reservoir of continual infestation and should be cleaned from bins and other storage places prior to storage of new grain.

A NEW GENUS OF PANURGINE BEES FROM ARIZONA (Hymenoptera, Andrenidae)[1]

CHARLES D. MICHENER
Lawrence, Kansas

The genera among bees are mostly quite clearly distinct and easily recognized units, frequently of large size. Since most authors have used subgenera for less important units, the genus has not been degraded as it has in many insect groups. The discovery of a new genus from North America is, therefore, of more than usual interest to bee students.

Xenopanurgus new genus

Type species: *Xenopanurgus readioi* new species.

This genus runs to the vicinity of *Calliopsis* and *Hypomacrotera* in the key to North American Panurgini (Michener, 1944), agreeing with these genera in the slender pterostigmata, the short subantennal areas, and other characters. It differs from these genera in its metallic coloration, the large clypeal emargination (male), the shorter marginal cell, and especially by the entirely different male genitalia.

Rozen (1951) has recently shown that the panurgine bees can be divided into several subgroups on the basis of the genitalia. The reduced gonostyli and very large penis valves, as well as other features characteristic of *Calliopsis, Hypomacrotera, Nomadopsis,* and *Acamptopoeum* are not found in *Xenopanurgus*. The inflexed gonocoxal apodemes suggest Rozen's group of *Psaenythia* and *Pseudopanurgus,* but the slender pterostigmata, short subantennal areas, and other features separate *Xenopanurgus* from these genera. The only other North American panurgine bees which are metallic are in the isolated genus *Perdita,* from which *Xenopanurgus* differs in many characters including the long marginal and second submarginal cells.

Body black with metallic blue tints and yellow markings on the face (at least in male). Pubescence sparse, not forming abdominal fasciae. Clypeus broad and extraordinarily short (male) with broad deep emargination in which lies the labrum; subantennal areas broad, inner subantennal sutures about as long as width of a subantennal area; paraocular areas strongly tumid; outer surface of each antennal scape (male) smooth, shining, and concave, thus fitting convexity of adjacent paraocular area. Proboscis with prementum and stipites subequal in length, about as long as an eye; postpalpal portions of galeae slightly more than half as long as stipites; maxillary palpi six-segmented, exceeding galeae, all segments large and conspicuous, second segment longest, first, third, fourth, and fifth subequal, sixth slightly shorter; glossa about half as long as prementum, tapering and acutely pointed; labial palpi five-sixths as long as prementum, four segmented, first segment nearly as long as remaining segments taken together,

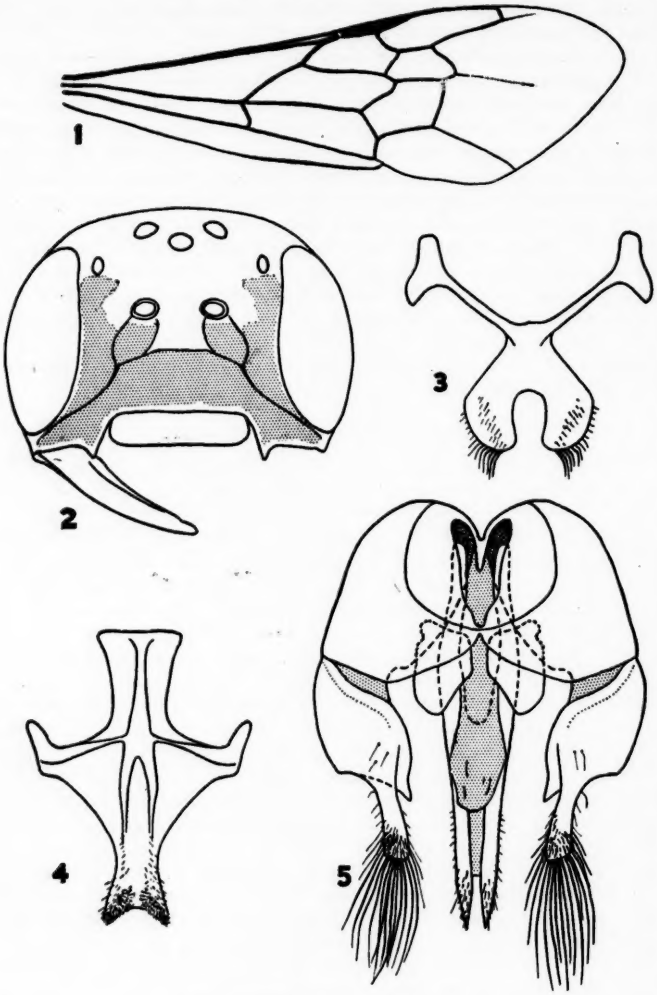
[1] Contribution Number 780 from the Department of Entomology of the University of Kansas, Lawrence.

the latter three subequal in length. Posterior lobes of pronotum each produced downward and laterally to form a sharp spine; pre-episternal suture or groove slanting strongly downward and forward, extending well below level of episternal scrobe. Middle tarsi (male) somewhat shorter than hind tarsi; hind basitibial plate clearly defined. Fore wings with two submarginal cells, the second five-sixths as long as length of first along posterior margin and receiving recurrent veins a short distance from each end; pterostigma slender, as broad as distance from inner margin of prestigma to costal margin of wing, slightly longer than second submarginal cell, base of vein r in middle of pterostigma, distance from base of vein r to base of pterostigma nearly twice length of prestigma; apex of marginal cell obliquely truncate; distance from apex of pterostigma to truncation of marginal cell conspicuously less than distance from latter point to wingtip. Male genitalia with gonocoxal apodemes strongly inflexed, narrowing genital foramen; gonostyli clearly defined, produced to long narrow apices bearing brushes of hairs; volsellae free; penis valves slightly exceeding gonostyli, much exceeding penis which is rather short and apparently fused to penis valves.

Xenopanurgus readioi new species

In general shape this species resembles *Pseudopanurgus innuptus* Cockerell and its allies but differs in having a larger head, in the bluish coloration, and of course in the numerous distinctive generic characters.

Male: Length 10 mm. Body black with distinct bluish tint on all areas that are punctured or strongly roughened. Pubescence dull whitish, rather sparse. Head much broader than long; clypeus bright yellow except for narrow black apical margin; subantennal areas bright yellow; paraocular areas with bright yellow extending well above bases of antennae to lower ends of facial foviae where yellow is somewhat broadened and truncated; these yellow areas and superclypeal area smooth, shining, finely and sparsely punctured, punctures separated by three or four puncture widths; supraclypeal area and paraocular areas, especially at level of antennal sockets, strongly convex; facial foviae small, slightly elongated, black and smooth; supra-antennal area rather closely punctured except for rather large impunctate but minutely roughened area in front of and lateral to each lateral ocellus; vertex medially slightly more coarsely punctured than supra-antennal area, laterally very much more coarsely punctured, punctures separated by a puncture width of shining but minutely roughened ground; distance from lateral ocellus to compound eye more than twice distance between lateral ocelli; genal areas broader than eyes seen from side, finely roughened and shallowly punctured except for impunctate shining area immediately behind each eye, this area broadest above and tapering to a point below; hypostomal areas conspicuously roughened, slightly shining, only very sparsely punctured. Labrum brownish-black, less than twice as broad as long (appearing very short in figure because it is slanting); mandibles brownish-black; antennae black, under surface of flagellum brownish beyond first three segments; first flagellar segment longer than next two together and more than twice as long as broad; second, third and fourth



EXPLANATION OF FIGURES

Xenopanurgus readioi new genus and species, male: 1, forewing; 2, face (yellow areas shaded); 3, seventh metasomal sternum; 4, eighth metasomal sternum; 5, ventral view of genitalia.

flagellar segments about as long as broad or slightly broader than long; remaining flagellar segments progressively longer so that subapical ones are distinctly longer than broad. Mesoscutum with punctures about size of those of median portion of vertex but separated by a puncture width or slightly more in most areas instead of being close together; interspaces between punctures of mesoscutum shining but minutely roughened; mesoscutellum with punctation similar to that of mesoscutum but slightly coarser; metanotum with punctation similar to that of mesoscutum but slightly finer and closer; dorsum of propodeum with ill-defined triangular area bearing weak longitudinal striae; remainder of dorsum of propodeum minutely roughened but not conspicuously punctured. Sides of thorax and posterior face of propodeum dull and minutely roughened, with coarse punctures (separated in most areas by a puncture width or more) except on posterior margins of mesepisterna, anterior margins of propodeum and entire metapleura, these area being impunctate or nearly so although dull; tegulae translucent dark brown, smooth and shining except anteriorly where they are minutely punctured. Legs brownish-black, tibial spurs testaceous, basitarsi of fore legs shorter than remaining tarsal segments taken together, of other legs equal to remaining tarsal segments taken together. Wings slightly smoky, particularly apically, veins and stigma dark brown. Metasoma with posterior margins of terga and sterna broadly depressed, these depressed portions minutely roughened but impunctate, non-metallic, extreme margins brownish; first to fourth and to a lesser extent fifth terga with areas in front of these depressed margins strongly elevated, especially laterally, but conspicuously so also medially, smooth, shining and very sparsely punctured, the punctures medially fine and separated by many puncture widths, laterally rather coarse and separated by two to four puncture widths; first tergum similarly shining and sparsely punctured all the way to base; other terga with bases rather densely punctured, minutely roughened between punctures; sixth tergum punctured throughout except for broad depressed apical margin. Seventh tergum but little exposed, dorsum flat but not forming a defined pygidial area, apex narrowly truncate. First sternum strongly convex, minutely roughened, with only very sparse scattered punctures; second and third sterna minutely roughened, slightly elevated in front of depressed apical margins, the elevations more shining than other portions of sterna. Fourth sternum similar but with elevation, which is approximately in middle of exposed portion of sternum, more conspicuous, forming a distinct transverse shining ridge, weakened medially; fifth sternum punctured throughout, surface minutely roughened and rather dull, basolateral portions of sternum strongly convex, area between these convexities bearing a fringe of yellowish hairs, posterior margin of sternum produced to form two rather slender lobes forming between them a deep U-shaped emargination, these lobes bearing dense fuscous hairs on their under surfaces; sixth sternum slightly concave seen from beneath, shining but sparsely punctured and minutely roughened, posterior margin produced as a thin plate the margin of which is strongly convex and bears a small deep U-shaped emargination medially; seventh sternum completely con-

cealed in life, bearing a pair of large apical lobes each of which is fringed at its apex; eighth sternum produced to a slightly emarginate heavily sclerotized and tufted apex which is slightly exposed in life.

Holotype male: Huachuca Mountains, Arizona, August 1, 1927 (P. A. Readio), in the Francis Huntington Snow Entomological Collections.

This species is named in honor of its collector, the late Philip A. Readio, teacher of entomology at the University of Kansas and Cornell University.

LITERATURE CITED

MICHENER, CHARLES D. 1944. Comparative external morphology, phylogeny, and a classification of the bees (Hymenoptera), Bull. Amer. Mus. Nat. Hist., 82:156-326.

ROZEN, JEROME G. 1951. A preliminary comparative study of the male genitalia of Andrenidae (Hymenoptera, Apoidea, Jour. Kansas Ent. Soc., 24:142-150.

NOTES ON KANSAS BUTTERFLIES

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We have previously reported[1] a number of interesting butterflies from the "Red Hills" of Barbour County, Kansas. In 1946 we first started collecting the narrow canyons of that area where we discovered *Amblyscirtes oslari* Skinner. We found that *oslari* usually flew towards the mouths of these canyons and would alight on the ground. Farther up the canyons, toward the heads we found a second *Amblyscirtes* which often would light on the ground and sometimes on grass stalks. This species has given us considerable trouble in trying to identify it as it belongs to the *aenus-erna-linda* complex. We submitted the specimens to H. A. Freeman who described *Amblyscirtes erna* and *linda*. He concurs that these Kansas specimens are *Amblyscirtes erna,* though they are not typical. This is a new record for Kansas. This species flies during the last of April and first of May.

[1] The Journal of the Kansas Entomological Society, Vol. 20, No. 3, page 92, July, 1947.

A NEW SPECIES OF GONIODES

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Goniodes leucurus n. sp.

Female: Head circumfasciate; clypeal margin broadly rounded with prominent angles. Temples angular, much wider than preantennal region of head. Clypeal band narrow; eyes prominent. Antennae filiform. Prothorax short and narrow. Pterothorax short and wide, without lateral indications of meso-metathoracic junctions. Dorsal chaetotaxy of head as in *Goniodes lagopi* (Linn. 1758). Dorsal chaetotaxy of posterior margin of pterothorax; 2-4-2. Legs characteristic of the genus. Abdomen large and elongate. Vulva with short marginal setae, and with concentrations of 16 medium length setae at each posterolateral angle. Spinous processes prominent, elongated and narrow.

Male: Very similar to *Goniodes lagopi* (Linn. 1758) in size and form. First antennal segments large, each with a prominent blunt process bearing an elongated spine. Male genitalia easily distinguishes this form from related species.

Abdominal chaetotaxy of tergites.

Segments	Male	Female
I	3-2-3	2-8-2
II	2-2-2	2-8-2
III	2-2-2	2-8-2
IV	2-2-2	2-6-2
V	2-2-2	2-4-2
VI	2-2-2	2-4-2
VII	4---4	2---2

Discussion.

The author recently stated (*J. Kans. Ent. Soc.*, XXIII, 1950, p. 125) that material of this genus had been examined from all native species of gallinaceous birds from North America. This statement was in error and undoubtedly resulted from the misidentification of a host collected in Alaska. Dr. C. F. W. Muesebeck has kindly loaned the author material from *Lagopus lecurus* (probably *penisularis* Chapman) so that the study could be completed.

Goniodes leucurus n. sp. resembles both *G. lagopi* (Linn. 1785) and *G. corpulentus* Kellogg and Mann 1912. The female is easily distinguished from these two forms by a difference in the abdominal chaetotaxy and in the structure of the genital region.

Holotype male, allotype female and paratypes from *Lagopus leucurus* (probably *peninsularis* Chapman), Kenai White-tailed Ptarmigan, collected August 22, 1950, by Mr. R. B. Williams on Willow Creek, Talkeetna Mountains, Alaska.

THE COMPARATIVE MORPHOLOGY OF THE MALE GENITALIA OF THE NOTONECTIDAE (Hemiptera)*

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This paper presents the results of a comparative morphological study of the ninth segment and its appendages in male backswimmers. All genera of the Notonectidae have been studied, but since only a few species in each genus were dissected, additional investigations may well be worth while.

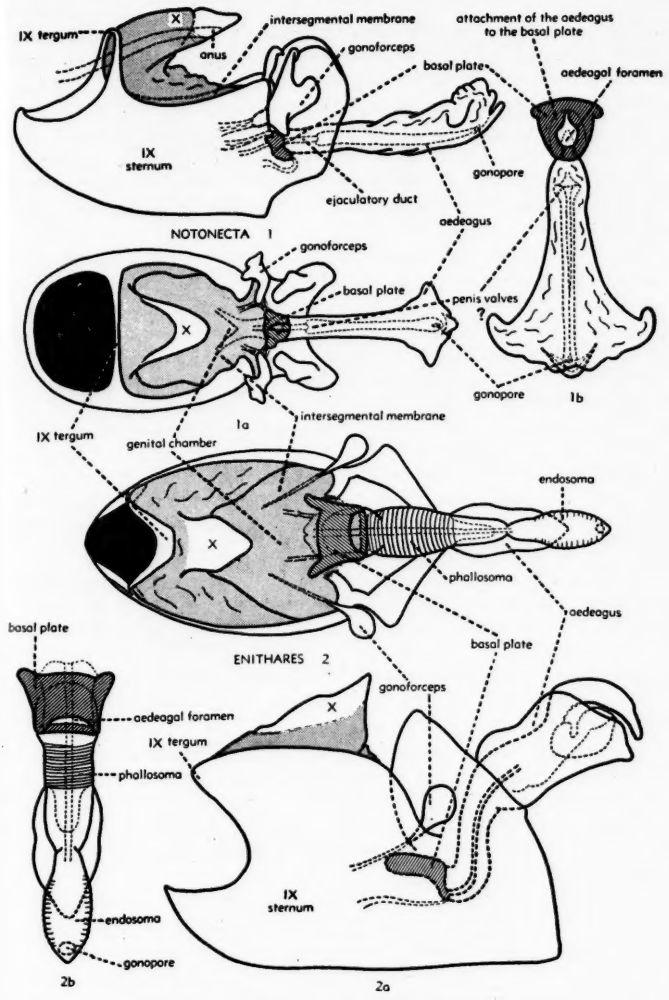
Before presenting the morphological findings of this study, it is necessary to establish certain structural homologies of the male copulatory apparatus. The terminology employed by Michener (1944) and by Singh-Pruthi (1924) has been followed in this paper. A majority of the homologies indicated are those suggested by them.

The ventral or the sternal part of the ninth segment in the Notonectidae is very large, projecting much beyond the dorsal or the lateral regions. This segment is generally referred to as the genital capsule by hemipterists. Loss of structures or fusion of parts, or both, have occurred to form the typical genital capsule found in the Notonectidae. This structure consists essentially of the sternal portion of the ninth segment, a median tubular organ, the aedeagus, and a pair of lateral appendages, the gonoforceps (gonocoxites or fused gonocoxites and gonostyli) which are always in association with the base of the aedeagus.

In the Notonectidae, as in most Heteroptera, the highly membranous distal region (endosoma) of the aedeagus is invaginated into the differentially sclerotized proximal portion (phallosoma). A number of diverticula may be found in either region. At the base of the aedeagus, surrounding the aedeagal foramen, a heavily sclerotized plate or ring is found. These basal plates are found in all Heteroptera but in various stages of modification. To the basal plates are attached powerful muscles which govern the movements of the aedeagus. The ejaculatory duct, as it enters the aedeagus, passes through the ring formed by the basal plate. The aedeagus is attached to the margins of the basal plate. The penis proper sometimes contains a pair of sclerotized rods. These may be remnants of the penis valves. They are ventrally located in the proximal region and usually disappear distad. When these rods are absent, usually a sclerotic area is found at the base of the penis at its point of juncture with the basal plate. The gonoforceps are one-segmented, arising from inflections in the posterior margin of the ninth sternum. Whether they represent the gonocoxites, the gonostyli, or appendages formed by the fusion of both is difficult to say. The bases of these gonoforceps are connected to the dorso-lateral arms of the basal plate by muscles and slightly sclerotized membrane. In some genera of the Notonectidae the gonoforceps are small and appear non-functional, while in others they are very large and cup-shaped, holding within them the aedeagus.

* Contribution No. 765 from the Department of Entomology of the University of Kansas.

PLATE I



EXPLANATION OF PLATE

Plate I: Male genitalia of *Notonecta* and *Enithares*.

Fig. 1. *Notonecta undulata* Say, lateral view of genital capsule.

Fig. 1a. *Notonecta undulata* Say, dorsal view of genital capsule.

Fig. 1b. *Notonecta undulata* Say, dorsal view of aedeagus with basal plate still attached ventrally.

Fig. 2. *Enithares abbreviata* (Kirby), dorsal view of genital capsule.

Fig. 2a. *Enithares abbreviata* (Kirby), lateral view of genital capsule.

Fig. 2b. *Enithares abbreviata* (Kirby), dorsal view of aedeagus with basal plate still attached ventrally.

The ninth tergum is very small and fused to the sternum, forming a narrow bridge in all the Notonectidae except in the specialized genera *Anisops* and *Buenoa*. In these two genera the tergum consists of two sclerotic arms projecting anteriorly from the antero-dorsal margins of the sternum.

The tenth segment is extremely small while the intersegmental membrane between this and the ninth is very large. The aedeagus originates in this intersegmental membrane. A membranous pouch or genital chamber is formed by this intersegmental membrane within which lies the copulatory organ.

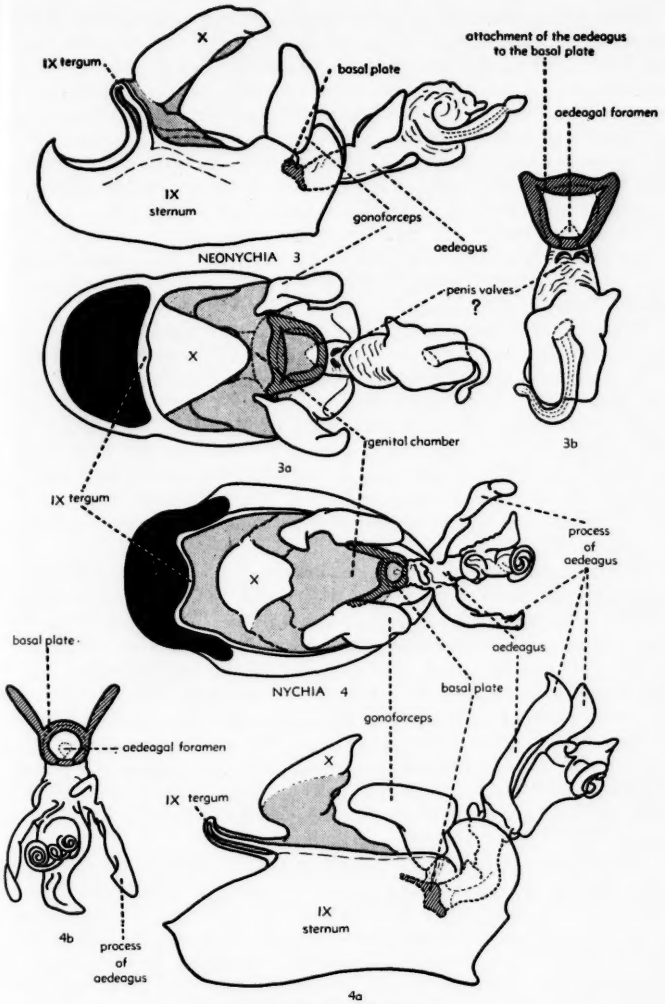
Before presenting the comparative morphology of the notonectid genitalia, it is first necessary to mention briefly what has been found in the supposedly more generalized homopteran male genitalia. Particular attention is devoted to the modifications found in the basal plate. Marks (1951) finds that in the Homoptera the basal plate is a T-shaped structure in the generalized forms and is progressively modified so as to form a ring-like structure in the more specialized forms. This plate has undergone a 270° rotation from a primitive dorso-ventral position to an antero-posterior position as found in the Saldidae. Due to this rotation, the intersegmental membrane becomes invaginated to form the genital chamber which is found in all Heteroptera. In the Homoptera the aedeagus is not attached to the margins of the basal plate as in the Heteroptera but is sclerotized and articulated in a caudal position.

The ring-like basal plate that is found in the specialized Homoptera is essentially the same as that found in the terrestrial Miridae, the semi-aquatic Saldidae, and the aquatic Notonectidae. In the latter family, however, we see the solid ring-like basal plate of the primitive *Notonecta* become, in general, progressively less sclerotized at the ventral point of fusion, until we find in the specialized *Anisops* and *Buenoa*, an open ring connected only by a membrane.

In presenting the morphology of the ninth abdominal segment of the Notonectidae, an attempt has been made to consider the genera beginning with the most generalized and progressing to the most highly specialized. No linear arrangement, however, is consistent in all regards. The best one can do is to observe the fundamental differences and allow for parallel and independent modification.

In the genus *Notonecta* (N. *undulata* Say) the basal plate is small, expanded, and fused completely in the ventral region forming a ring. This ventral region, however, shows less sclerotization than the rest of the plate. The aedeagus is not clearly differentiated into phallosoma and endosoma but these can be distinguished. The aedeagus is cylindrical and narrow proximally but very wide distally. A pair of longitudinal sclerotic rods are present ventrally which may very well be the penis valves. The gonoforceps are small and symmetrical. The genital capsule is cleft posteriorly, making it possible for the aedeagus to be readily projected from the capsule. The ninth tergum forms a narrow bridge across the anterior region of the capsule.

PLATE II



EXPLANATION OF PLATE

PLATE II: Male genitalia of *Neonychia* and *Nychia*.

Fig. 3. *Neonychia congoensis* (Hungerford), lateral view of genital capsule.

Fig. 3a. *Neonychia congoensis* (Hungerford), dorsal view of genital capsule.

Fig. 3b. *Neonychia congoensis* (Hungerford), dorsal view of aedeagus with basal plate still attached ventrally.

Fig. 4. *Nychia marshalli* Scott, dorsal view of genital capsule.

Fig. 4a. *Nychia marshalli* Scott, lateral view of genital capsule.

Fig. 4b. *Nychia marshalli* Scott, dorsal view of aedeagus with basal plate still attached ventrally.

In the genus *Enithares* [*E. abbreviata* (Kirby)] the basal plate is large, expanded, and fused in the ventral region forming a ring as in the *Notonecta*. The lateral arms of the plate are heavily sclerotized. The dorsal portion of the ring is very wide while the ventral portion is narrow, both being only lightly sclerotized. The aedeagus is differentiated into phallosoma and endosoma and both are easily recognized. The proximal portion of the phallosoma is narrow, cylindrical, and annulated, while the distal portion is wide and lightly sclerotized. The penis valves are not visible. The gonoforceps are symmetrical and extremely small in the species studied. There is at least one species (*E. brasiliensis* Spinola), however, that has large and asymmetrical gonoforceps. The genital capsule is cleft posteriorly forming two large lobes. The ninth tergum forms a broad bridge across the anterior region of the capsule.

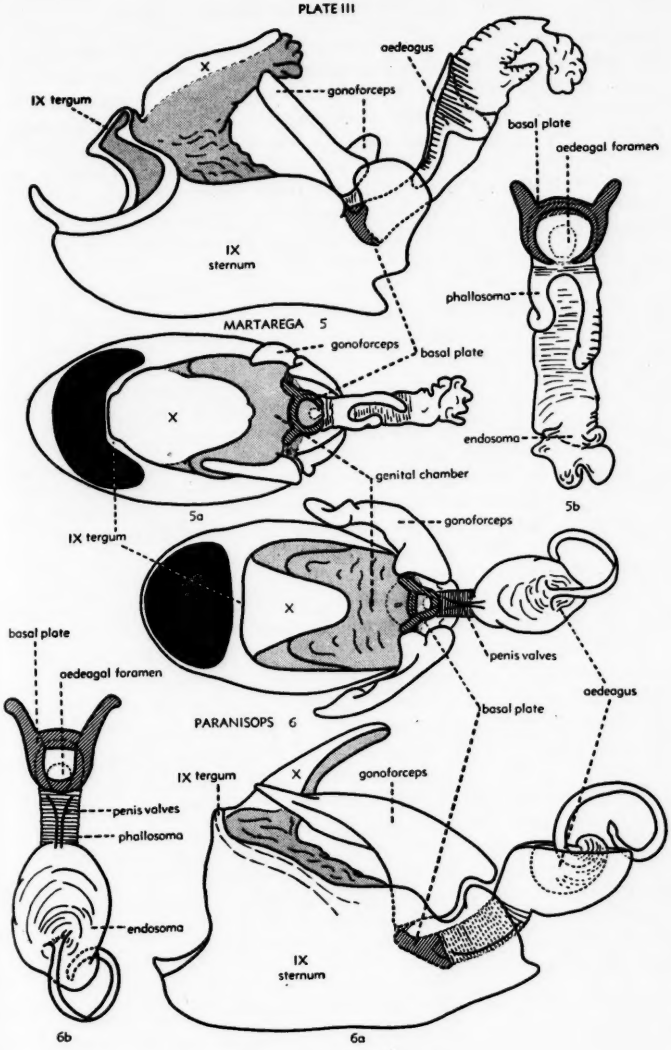
In the genus *Neonychia* [*N. congoensis* (Hungerford)] the basal plate is relatively large and the ring is connected on the ventral surface by only a very slightly sclerotized area. The phallosoma and endosoma of the aedeagus are easily distinguishable, the former being slightly sclerotized while the latter is membranous and possesses variously shaped diverticula. Only the faintest remnants of the penis valves are visible ventrally near the base of the aedeagus. The gonoforceps are asymmetrical and of moderate size. The genital capsule is cleft posteriorly as in the two preceding genera. The ninth tergum forms a narrow bridge slightly anterior to a median position on the genital capsule.

In the genus *Nychia* (*N. marshalli* Scott and *N. malayana* Lundblad) the basal plate forms a ring, with the ventral area of fusion closed by a membrane which is very slightly sclerotized. The lateral arms of the basal plate are very long and project anteriorly and dorsad. The aedeagus is a complicated structure with two long, lateral diverticula arising on the phallosoma and extending the length of the aedeagus. The phallosoma and endosoma are not clearly differentiated. Located distally on the aedeagus is a coiled, very slightly sclerotized tube which terminates in the gonopore. Not a vestige of the penis valves is to be found. The gonoforceps are asymmetrical and of moderate size. Again we find the genital capsule cleft posteriorly. The ninth tergum forms a very narrow bridge across the anterior region of the genital capsule.

In the genus *Martarega* (*M. gonostyla* Truxal) the basal plate is an open ring, the ventral region being connected only by the membrane of the aedeagus. The aedeagus is differentiated into phallosoma and endosoma; the former is partially sclerotized, surrounds the more membranous portion of the aedeagus, and bears two short diverticula. There is no sign of the penis valves. The gonoforceps are asymmetrical; the left is much larger than the right. The genital capsule is cleft behind. The ninth tergum forms a narrow bridge across the anterior region of the capsule with the dorsal portion of the bridge extremely narrow.

The genus *Paranisops* (*P. inconstans* var. *lutea* Hale) should follow the genus *Enithares* in the phylogenetic series if based on most of the genitalic characters. The basal plate forms a closed ring with the ventral region

PLATE III



EXPLANATION OF PLATE

Plate III: Male genitalia of *Martarega* and *Paranisops*.

Fig. 5. *Martarega gonostyla* Truxal, lateral view of genital capsule.

Fig. 5a. *Martarega gonostyla* Truxal, dorsal view of genital capsule.

Fig. 5b. *Martarega gonostyla* Truxal, dorsal view of aedeagus with basal plate still attached ventrally.

Fig. 6. *Paranisops inconstans* var. *lutea* Hale, dorsal view of genital capsule.

Fig. 6a. *Paranisops inconstans* var. *lutea* Hale, lateral view of genital capsule.

Fig. 6b. *Paranisops inconstans* var. *lutea* Hale, dorsal view of aedeagus with basal plate still attached ventrally.

closed by a slightly sclerotized band. The phallosoma and endosoma are distinguishable, the former being cylindrical, narrow, and annulated in the proximal region and wide in the distal region. The endosoma possesses a coiled, slightly sclerotized tube, at the end of which is located the gonopore. Again in this genus we find a pair of ventrally located sclerotic rods that arise proximally in the phallosoma and disappear distad. These, as mentioned previously, are presumably the remnants of the penis valves. The gonoforceps are very large and asymmetrical. The genital capsule is cleft behind. The ninth tergum forms a moderately wide bridge across the anterior region of the genital capsule.

In the genus *Anisops* (*A. genji* Hutchinson) the basal plate is an open ring with the wide ventral opening closed only by the membrane of the aedeagus. The lateral arms are long and project anteriorly and dorsad. The phallosoma and endosoma are easily recognized; the former is narrow, cylindrical, and annulated in the proximal region, and wide and slightly sclerotized in the distal region. On the phallosoma are located variously shaped diverticula. The endosoma is membranous and narrows distally into a tube which possesses the gonopore. The base of the aedeagus is slightly sclerotized at its point of attachment to the basal plate and bears a pair of very small sclerotic bars which are located ventrally and may be remnants of the penis valves. The gonoforceps are asymmetrical, moderately large, and cup-shaped. The genital capsule is closed posteriorly so that the aedeagus projects dorsad from the capsule. The ninth tergum does not form a bridge as in the preceding genera but in its place are found two tergal arms which project anteriorly from each side of the capsule.

In the last genus, *Buenoa* [*B. elegans* (Fieber) and *B. arizonis* Bare], the genitalic characters resemble those of *Anisops* very much. The basal plate is almost identical to that of the preceding genus, being an open ring with the wide ventral gap closed only by the membrane of the aedeagus. The phallosoma and endosoma are easily recognized; the former is narrow, cylindrical and annulated in the proximal region and wide and very slightly sclerotized distad. The endosoma is membranous and narrows distally into a tube which possesses the gonopore. The base of the aedeagus is sclerotized at its point of attachment to the basal plate and what may be the small remnants of the penis valves are faintly visible ventrally. The gonoforceps are asymmetrical, moderately large, and cup-shaped, holding within them the aedeagus. The genital capsule is closed behind. The ninth tergum does not form a bridge but the tergal arms project anteriorly from each side of the capsule.

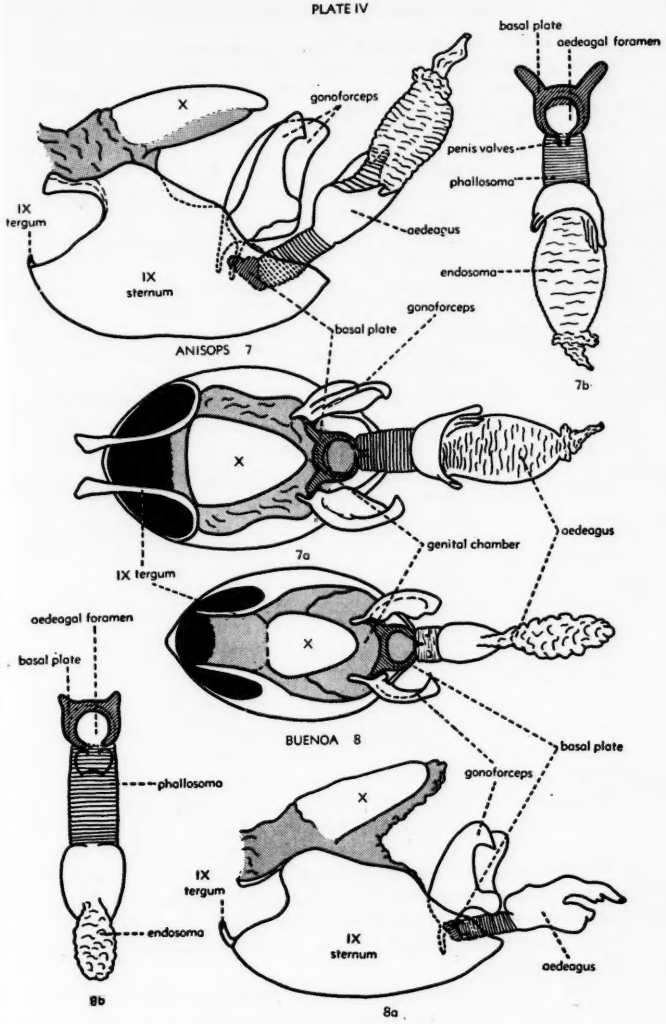
GLOSSARY OF TERMS APPLIED TO THE MALE GENITALIA

Aedeagus—The penis and penis valves. The penis valves are sometimes completely fused with the outer wall of the penis.

Basal plate—A heavily sclerotized plate surrounding the basal foramen of the aedeagus. If the homologies indicated by Michener (1944) and Marks (1951) are correct, this plate is derived from the basal portions of the penis valves.

Endosoma—The distal region of the aedeagus (doubtless penis) which is invaginable into the phallosoma.

PLATE IV



EXPLANATION OF PLATE

Plate IV: Male genitalia of *Anisops* and *Buenoa*.

Fig. 7. *Anisops genji* Hutchinson, lateral view of genital capsule.

Fig. 7a. *Anisops genji* Hutchinson, dorsal view of genital capsule.

Fig. 7b. *Anisops genji* Hutchinson, dorsal view of aedeagus with basal plate still attached ventrally.

Fig. 8. *Buenoa elegans* (Fieber), dorsal view of genital capsule.

Fig. 8a. *Buenoa elegans* (Fieber), lateral view of genital capsule.

Fig. 8b. *Buenoa elegans* (Fieber), dorsal view of aedeagus with basal plate still attached ventrally.

Genital chamber—A membranous pouch formed by the intersegmental membrane between the ninth and tenth sterna in which lies the aedeagus.

Gonoforceps—The fused gonocoxites and gonostyli, or a generalized collective term for both of these structures when present.

Gonocoxites—The gonocoxopodites except for penis valves, volsellae, and gonobase when present. The basal segments of the outer claspers.

Gonocoxopodites—The coxopodites of the gonopods.

Gonopods—The pair of segmental appendages of the ninth abdominal segment.

Gonopore—The opening at the apex of the ejaculatory duct.

Gonostyli—The styli articulated to the apices of the gonocoxites (absent, at least as separate structures, in Hemiptera).

Penis—The intromittent organ proper or phallus. This structure, which is not of appendicular origin, terminates in the gonopore.

Penis valves—Mesal basal processes of the gonocoxopodites which usually serve to support the penis. Presumably these structures are the gonapophyses of the ninth segment appendages (see Michener, 1944).

Phallosoma—The proximal region of the aedeagus into which is invaginated the distal endosoma.

LITERATURE CITED

MARKS, E. P. 1951. Comparative studies of the male genitalia of the Hemiptera. Journal of the Kansas Entomological Society, 24:134-141, 11 figs.

MICHENER, C. D. 1944. A comparative study of the appendages of the eighth and ninth abdominal segments of insects. Annals of the Entomological Society of America, 37:336-351, 3 pls.

SINGH-PRUTHI, HEM. 1925. The morphology of the male genitalia in Rhynchota. Transactions of the Entomological Society of London, 1925: 127-267, 27 pls.

BOOK NOTICE

AMERICAN SOCIAL INSECTS, by Charles D. Michener and Mary H. Michener. xiv+267 pages, 30 plates in color, 79 plates in gravure. D. Van Nostrand Company, Inc. 1951. Price, $6.00.

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The book closes with a bibliography, a glossary, and the index.

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Paul B. Lawson

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